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#exptime1
#import numpy as np

# Raw Blue and V data (from image)
b_data = np.array([
    [152, 152, 152, 152],
    [1410, 1410, 1410, 1410],
    [4626, 4626, 4626, 4626],
    [7109, 7108, 7108, 7108],
    [7119, 7119, 7118, 7118],
    [7122, 7122, 7122, 7123]
])

v_data = np.array([
    [153, 152, 152, 152],
    [1410, 1411, 1410, 1411],
    [4617, 4616, 4616, 4617],
    [7108, 7108, 7108, 7118],
    [7119, 7119, 7119, 7119],
    [7123, 7123, 7123, 7123]
])

# Subtract background count (7 electrons)
background = 7
b_corr = b_data - background
v_corr = v_data - background

# Compute averages and standard deviations across each row (voltage level)
B_avg = b_corr.mean(axis=1)
V_avg = v_corr.mean(axis=1)

# Apply the formula: (2.5 / ln(10)) * (1 / sqrt(count))
B_std = (2.5 / np.log(10)) * (1 / np.sqrt(B_avg))
V_std = (2.5 / np.log(10)) * (1 / np.sqrt(V_avg))

# Compute color index and its uncertainty
ln10 = np.log(10)
color_index = -2.5 * np.log10(B_avg / V_avg)
color_error = np.sqrt((B_std**2) + (V_std**2))
# Compute temperature and its uncertainty
temperature = 8540 / (color_index + 0.865)
temp_error = (8540 / (color_index + 0.865) ** 2) * color_error

# Compute average temperature and RMS of temperature error
avg_temp = np.mean(temperature)
rms_temp_error = np.sqrt(np.mean(temp_error ** 2))

# Print results with all intermediate values

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for i in range(len(B_avg)):
    print(f"Voltage {i+1}V:")
    print(f"  Avg Blue Count: {B_avg[i]:.2f}, ")
    print(f"  Avg V Count   : {V_avg[i]:.2f}, ")

    print(f"  Temperature   : {temperature[i]:.2f} K ±
{temp_error[i]:.2f} K\n")

Voltage 1V:
  Avg Blue Count: 145.00,
  Avg V Count   : 145.25,
  Temperature   : 9851.53 K ± 1448.50 K

Voltage 2V:
  Avg Blue Count: 1403.00,
  Avg V Count   : 1403.50,
  Temperature   : 9868.42 K ± 467.42 K

Voltage 3V:
  Avg Blue Count: 4619.00,
  Avg V Count   : 4609.50,
  Temperature   : 9898.41 K ± 259.34 K

Voltage 4V:
  Avg Blue Count: 7101.25,
  Avg V Count   : 7103.50,
  Temperature   : 9868.91 K ± 207.79 K

Voltage 5V:
  Avg Blue Count: 7111.50,
  Avg V Count   : 7112.00,
  Temperature   : 9871.96 K ± 207.78 K

Voltage 6V:
  Avg Blue Count: 7115.25,
  Avg V Count   : 7116.00,
  Temperature   : 9871.53 K ± 207.70 K

#exposutetime2
import numpy as np

# Raw Blue and V data (from image)
b_data = np.array([
    [552, 552, 554, 554],
    [6066, 6152, 6217, 6233],
    [23042, 23045, 23048, 23050],
    [35565, 35565, 35564, 35564],
])

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[35627, 35628, 35628, 35628],
[35651, 35650, 35650, 35650]
])

v_data = np.array([
    [541, 545, 547, 548],
    [6285, 6290, 6295, 6300],
    [22997, 22997, 23012, 23023],
    [35564, 35564, 35564, 35564],
    [35607, 35625, 35625, 35625],
    [35648, 35648, 35647, 35648]
])

# Subtract background count (7 electrons)
background = 7
b_corr = b_data - background
v_corr = v_data - background

# Compute averages and standard deviations across each row (voltage level)
B_avg = b_corr.mean(axis=1)
V_avg = v_corr.mean(axis=1)

# Apply the formula: (2.5 / ln(10)) * (1 / sqrt(count))
B_std = (2.5 / np.log(10)) * (1 / np.sqrt(B_avg))
V_std = (2.5 / np.log(10)) * (1 / np.sqrt(V_avg))

# Compute color index and its uncertainty
ln10 = np.log(10)
color_index = -2.5 * np.log10(B_avg / V_avg)
color_error = np.sqrt((B_std**2) + (V_std**2))
# Compute temperature and its uncertainty
temperature = 8540 / (color_index + 0.865)
temp_error = (8540 / (color_index + 0.865)) ** 2 * color_error

# Compute average temperature and RMS of temperature error
avg_temp = np.mean(temperature)
rms_temp_error = np.sqrt(np.mean(temp_error ** 2))

# Print results with all intermediate values
for i in range(len(B_avg)):
    print(f"Voltage {i+1}V:")
    print(f"  Avg Blue Count: {B_avg[i]:.2f}, ")
    print(f"  Avg V Count   : {V_avg[i]:.2f}, ")

    print(f"  Temperature   : {temperature[i]:.2f} K ±"
          f" {temp_error[i]:.2f} K\n")

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Voltage 1V:

Avg Blue Count: 546.00,
Avg V Count : 538.25,
Temperature : 10053.23 K ± 780.47 K

Voltage 2V:

Avg Blue Count: 6160.00,
Avg V Count : 6285.50,
Temperature : 9629.07 K ± 211.34 K

Voltage 3V:

Avg Blue Count: 23039.25,
Avg V Count : 23000.25,
Temperature : 9893.87 K ± 116.00 K

Voltage 4V:

Avg Blue Count: 35557.50,
Avg V Count : 35557.00,
Temperature : 9873.01 K ± 92.94 K

Voltage 5V:

Avg Blue Count: 35620.75,
Avg V Count : 35613.50,
Temperature : 9875.36 K ± 92.91 K

Voltage 6V:

Avg Blue Count: 35643.25,
Avg V Count : 35640.75,
Temperature : 9873.70 K ± 92.85 K